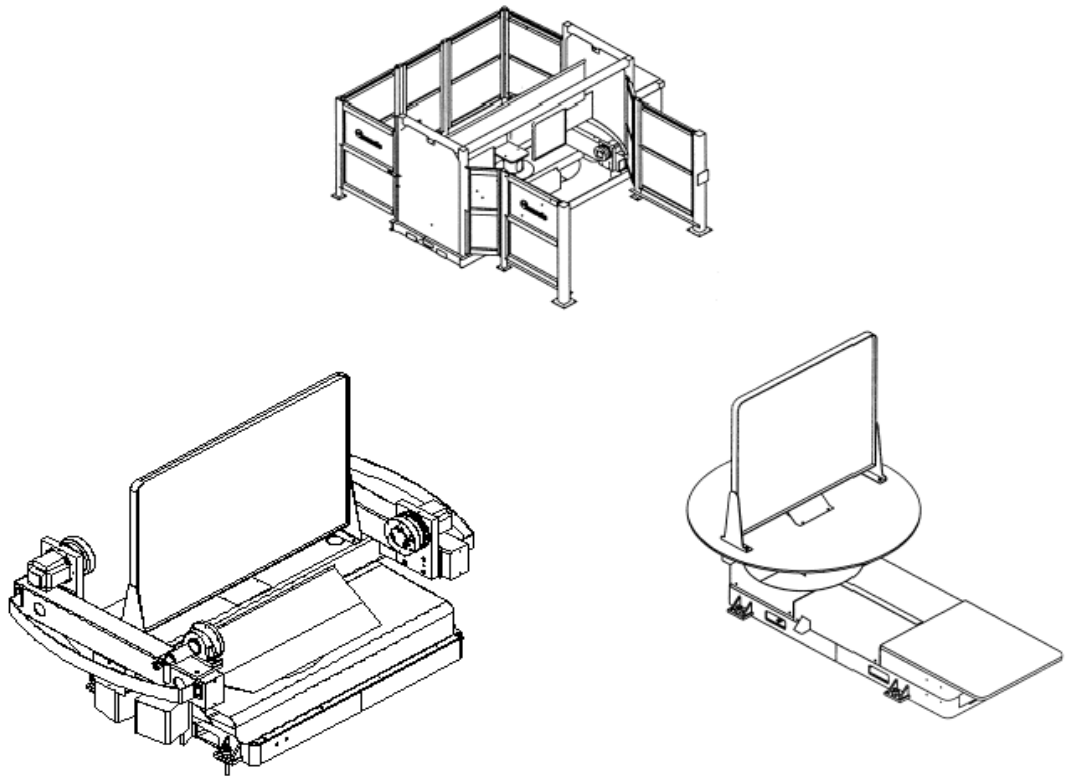
Turntable Positioner

Versa 3M, 3M3, RCT, RC3, RCTL, RC3L



User's Manual

PLATFORMATION

ROBOTIC WORKCELL PLATFORMS

by Genesis Systems Group

Important Safety Information

Genesis Systems Group is concerned with the safety and welfare of its customers and their employees. Careful consideration has been given to the design and integration of safety hardware and software into this system. The safety equipment is intended as a supplement to the customer's complete safety program for this installation. **These safety precautions are not meant to replace any related Federal, State or Municipal laws, regulations, or guidelines pertaining to safety.**

Genesis Systems Group believes that the appropriate levels of safety for an installation can best be determined by safety professionals who are most familiar with the intended application. **It is the responsibility of the customer** to insure that this level of safety is accomplished. We recommend that each customer consult with safety professionals in order to provide a workplace that allows for the safe application, use, and operation of this system.

For further information contact:

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Version 071409

Genesis® Systems Group

24 HOUR
HOTLINE

For a PRODUCTION machine that is DOWN
AFTER regular business hours call:

(563) 386-9693

For all other TROUBLESHOOTING and
TECHNICAL SUPPORT call:

(563) 445-5600

Regular business hours:
7:30 a.m. – 5:00 p.m. Central Time

*Please have your shop order number (SO or J #) and
your documentation readily available when
calling for assistance on your system.

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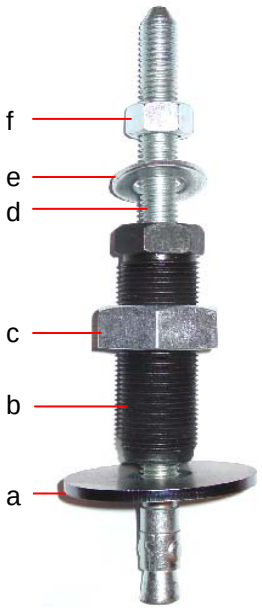
Positioner Installation

Installation of the Positioner involves leveling and anchoring the Positioner, setting up the air supply, balancing the tooling, and mounting the tooling.

Leveling and Anchoring

Parts supplied with Positioner (one per anchor point):

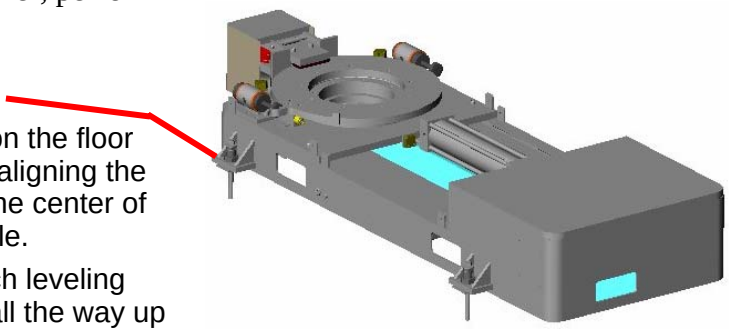
a) leveling pad
b) 1¼ inch leveling bolt
c) 1½ inch leveling nut
d) 5/8 inch anchor bolt (length varies)
e) 7/8 inch washer
f) 5/8 inch anchor nut



Tools supplied by user:

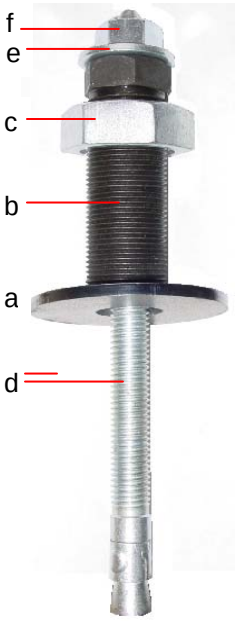
Level
Drill
1½ inch Socket wrench
15/16 inch Socket wrench
3 lb. Mallet hammer

To ensure proper operation, the Positioner must be level front-to-back and side-to-side. To level the Positioner, perform the following steps:



1. Locate all anchor holes.
2. Place a leveling pad (a) on the floor under each anchor hole, aligning the center of each pad with the center of each threaded anchor hole.
3. Thread a nut (c) onto each leveling bolt (b). Thread the nut all the way up the bolt. Thread a bolt/nut assembly (b,c) into each anchor hole until bolt touches leveling pad (a).
4. Place a level on the Positioner at various locations and adjust the height of each bolt (b) as necessary, until the Positioner is level front-to-back and side-to-side.

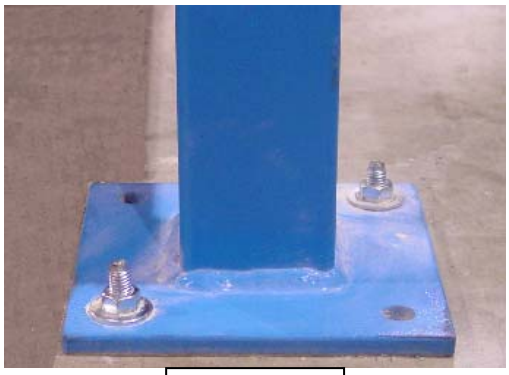
After leveling the Positioner, anchor it into position by performing the following steps:



5. Going through the center of each leveling bolt (b) with a 5/8 inch drill bit, drill into the cement floor about 1 inch farther than the length of the anchor bolt (d).
6. Add a washer (e) and nut (f) to each anchor bolt (d). Insert an anchor bolt assembly (d,e,f) through the leveling bolt, down into the floor.
7. Using a mallet hammer, pound down on the anchor bolt until the washer is flush with the leveling bolt (d).
8. Use a 15/16 inch wrench to hand tighten anchor nut (f).
9. Use a 1½ inch socket wrench to hand tighten each leveling nut (c).

If the Positioner has fence posts, anchor each post with 3/8 inch anchor bolts and nuts (usually four holes per post):

10. Going through each hole with a 3/8 inch drill bit, drill into the cement floor about one inch farther than the length of the anchor bolt.
11. Add a 3/8 inch washer and nut to each anchor bolt. Insert a washer/nut/bolt assembly through each hole, down into the floor.
12. Using a mallet hammer, pound down on the anchor bolt until it is about an inch above the floor bracket.
13. Use a 9/16 inch wrench to hand tighten each leveling nut.



Fence Post

Air Supply

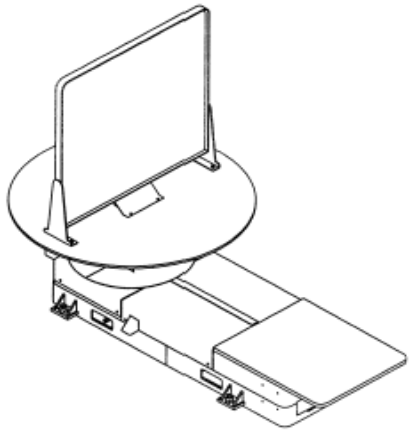
The air supply must conform to the following specifications:

- Unrestricted 3/8” minimum inside diameter supply line
- Filtered, moisture-free compressed air at 80 psi minimum
- 75 cfm rating @ 2 indexes per/minute

Tooling Installation

Tooling Without Minor Axes (3M, RCT, RCTL)

For Positioners that do not have minor axes, tooling and components must be securely mounted inside the maximum table diameter, and be within the maximum weight capacity of the Positioner. See System Specifications.



Tooling With Minor Axes (3M3, RC3, RC3L)

Balancing Tool

For proper tooling installation, the tool must be balanced within specifications. This involves:

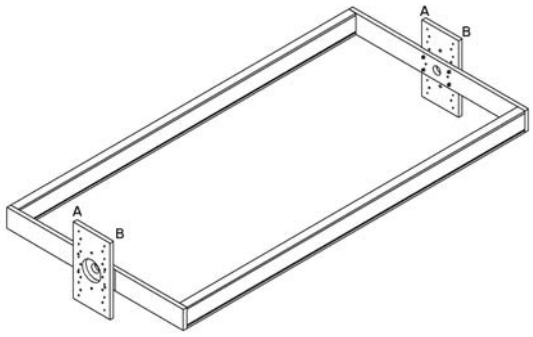
1. Finding total weight of tool plus parts.
2. Locating center of gravity
3. Calculating imbalance torque
4. Possibly altering assembly or using counterweights.

1. Find Total Tool/Part Weight

Determine the total weight of the tool plus parts by weighing the tool/part assembly.

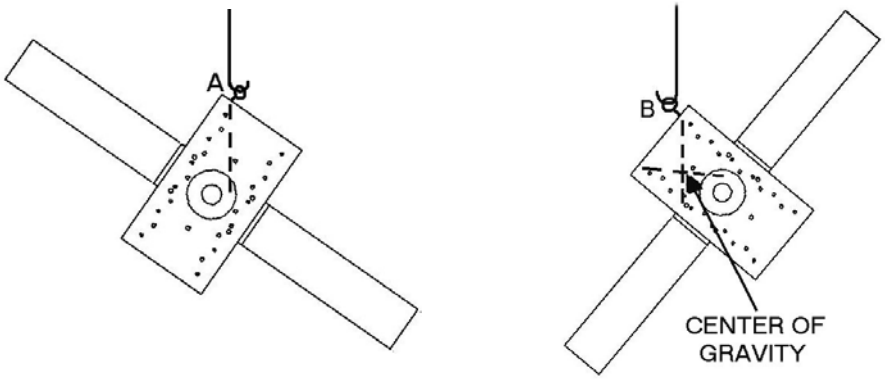
2. Locate Center of Gravity

If the center of gravity for the backbone (frame), tooling, and parts to be welded cannot be calculated easily, use the Crane-and-Plumb-Bob method:



1. Lift the assembly using two hooks. Place the first hook where an **"A"** is located, then place the other hook at the **"A"** on the other end. Lift the assembly and use a plumb-bob to mark a vertical line directly below the lifting point.
2. Set the assembly down and lift it again, but this time use the two points marked **"B"**. Again, mark a line straight down from the lifting points.

Where the two lines, A and B, intersect is the center of gravity for the assembly in two dimensions. The third dimension does not present a problem when dealing with Torque Imbalance and can be ignored.

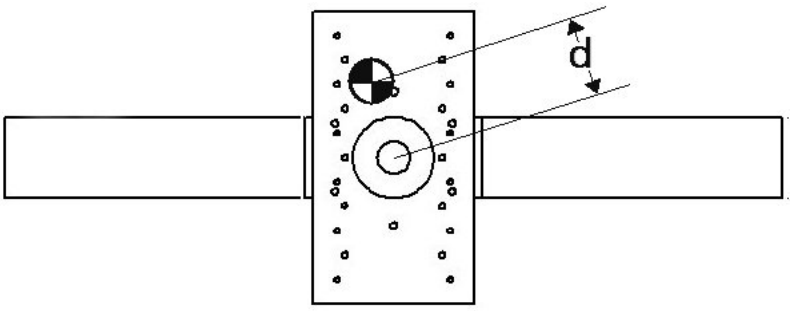


Crane-and-Plumb-Bob Method

3. Calculate Imbalance Torque

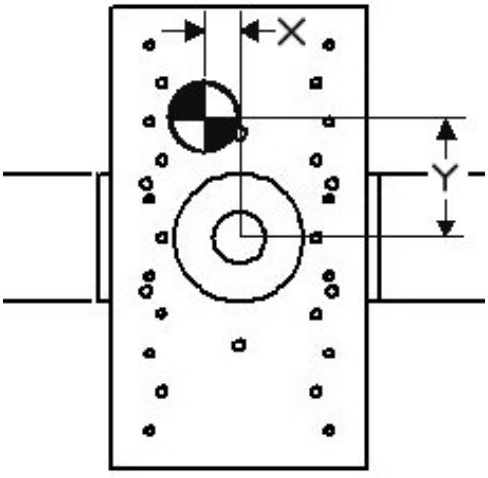
After finding the total weight of the tool/part assembly and locating the center of gravity, the Imbalance Torque must be calculated. The Imbalance Torque (T_I) is the product of the weight in lbs.(W), and the distance in inches from the axis of rotation to the center of gravity (d).

Equation: $T_I = W * d$



Imbalanced Torque

The calculated value, T_I , **must be less than 600 in-lbs**. If it is not, the tooling and backbone need to be altered so the center of gravity moves closer to the axis of rotation. Another solution is to balance the setup using counterweights to move the center of gravity.



Needs Balancing

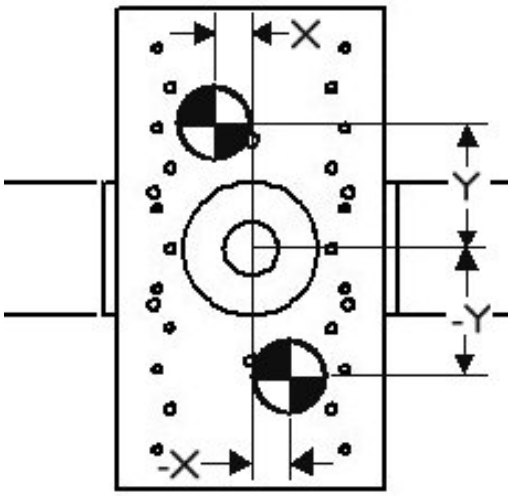
4. Alter Assembly or Use Counterweights

Alter Assembly

If the tooling, backbone, and objects to be welded are adjusted to change the center of gravity, recheck the center of gravity using the Crane-and-Plumb-Bob method. Then recalculate T_I. If T_I is less than 600 in-lbs, further alteration is not needed. If T_I is too large, continue to alter the assembly or consider using counterweights.

Use Counterweights

Counterweights can be used to alter an assembly's center of gravity. If the center of gravity lies at (X, Y) from the axis of rotation, then the assembly must be balanced so that $T_I < 600$ in-lbs. The easiest way to do this is to determine the weight acting at point (X, Y), then place a counterbalance of the same weight at point (-X, -Y). This will result in a balanced assembly. Also, if the weight needed at (-X, -Y) is too great, doubling the distance (-2X, -2Y) will allow the counterbalance weight to be halved.



Balanced Assembly

IMPORTANT!: If counterweights are used, they must remain inside the Swing Radius.

If a counterweight is used to alter the center of gravity, recheck the center of gravity using the Crane-and-Plumb-Bob method. Then recalculate T_I. If T_I is less than 600 in-lbs, further alteration is not needed. Make sure W includes the counterbalance weight. Also, make sure the gearbox has a high enough value.

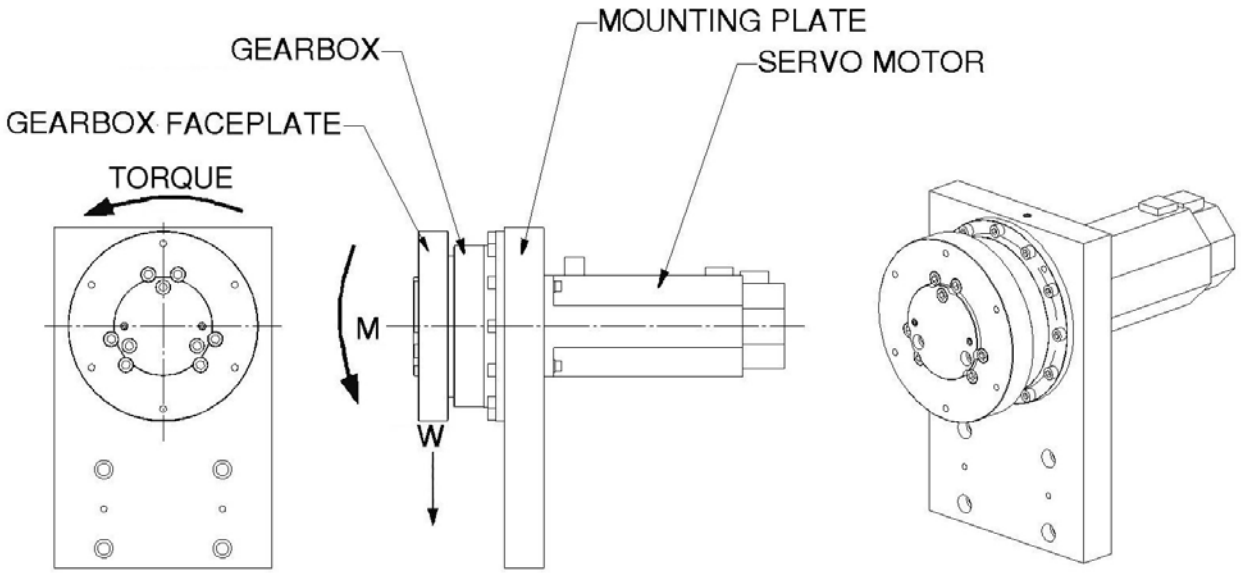
Mounting Tool

In a standard minor axis tooling installation, with a bearing at the tailstock end, the headstock end remains fixed while the tailstock bearing is simply supported. This allows the tooling shaft to move axially as the tooling deflects and pivots about the bearing.

To maintain structural integrity required of the Positioner, certain tooling specifications must be met.

Gearbox Mounting Plate

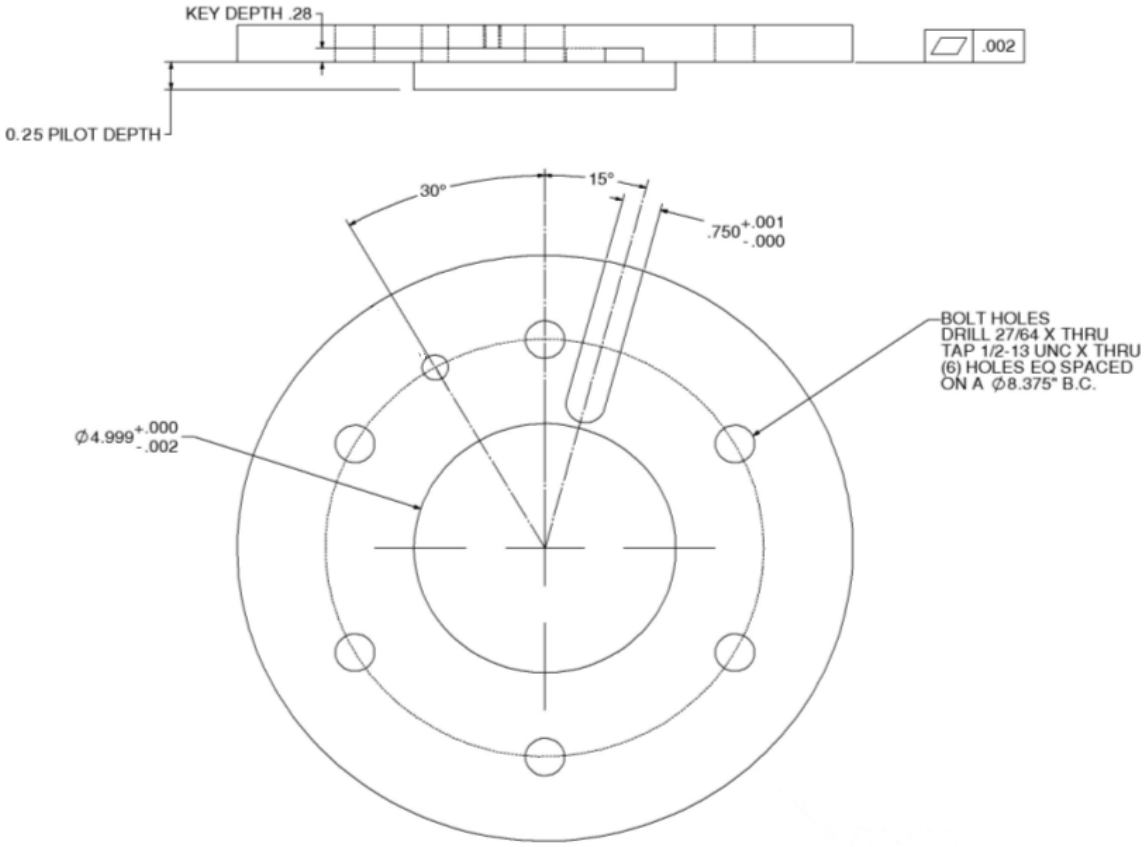
Tooling mounting plates must mate with gearbox faceplates provided by Genesis Systems Group.



Gearbox Faceplate

Each RV gearbox faceplate conforms to the specifications shown in the following diagram.

NOTE: Tooling should be mounted with ½ -13 grade 8 bolts and torqued to SAE standards.

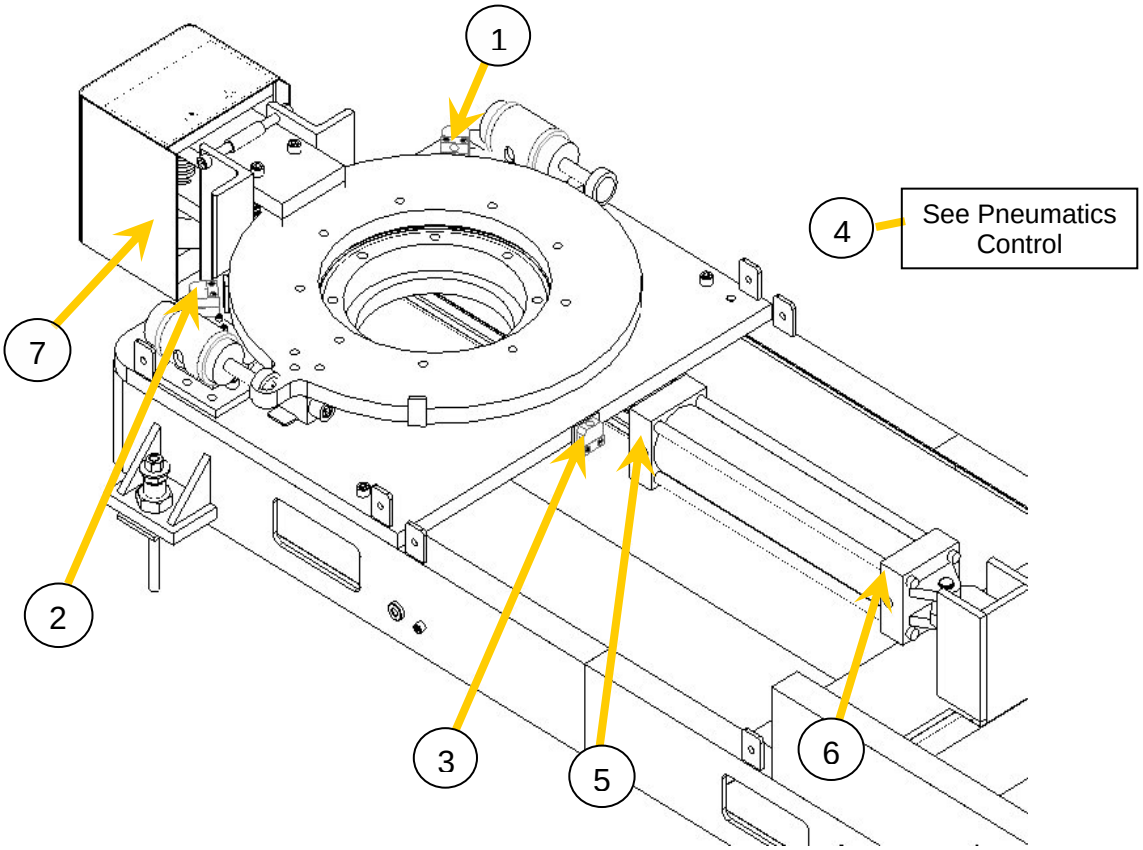


Gearbox Faceplate for RV Gearbox

Positioner Control

The Positioner is a system of components that work together to rotate a turntable between a load area and a robot area. The turntable has two sides, A and B. The components include one or two pneumatic cylinders, an air package, proximity sensors, shock absorbers, and a brake.

Control Components



Inputs

1 – Position ‘A’
2 – Position ‘B’
3 – Position ‘Center’
4 – Air Package

Outputs

5 – Cylinder Retract
6 – Cylinder Extend
7 – Brake Release

Control Component Details

INPUTS

1. Position ‘A’ – Control point used to indicate the Positioner is at position ‘A’. Two (2) proximity sensors are located at this point for integration with a control reliable circuit.

2. Position ‘B’ – Control point used to indicate the Positioner is at position ‘B’. Two (2) proximity sensors are located at this point for integration with a control reliable circuit.

3. Position ‘Center’ – Proximity sensor mounted at the center of the Positioner’s rotation, and is actuated by a tab attached to brake disc. This signal is used to reverse the cylinder’s direction from retract to extend.

4. Air Package – Air regulator used to maintain proper air flow (psi); pressure switch used to detect proper air flow (psi); brake override lever used to release brake, allowing table to be rotated by hand.

OUTPUTS

5. Cylinder Retract – Signal sent to cylinder air valve energizing the coil that retracts the cylinder. This is energized when Positioner rotation is started. It can also be used to slow down the Positioner at the end of sweep. The output is pulsed to briefly slow the speed.

6. Cylinder Extend – Signal sent to cylinder air valve energizing the coil that extends the cylinder. This is energized to hold the Positioner against the hard-stops, along with pushing the Positioner past center during rotation.

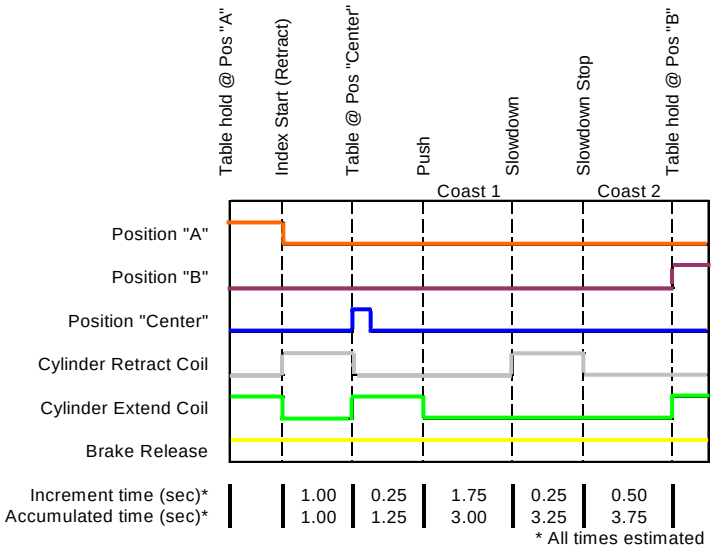
7. Brake Release – Signal sent to brake release air valve energizing the coil to release the brake. This is energized during normal operation. It is ***not*** used to control sweep speed, nor is it used for absolute positioning. The coil is de-energized to stop the Positioner in an ‘Emergency Stop’ condition. The manual override lever releases the brake, making the Positioner moveable by hand. The manual override also blocks air flow to the extend portion of the cylinder, making the environment safe to rotate the Positioner without electronic control.

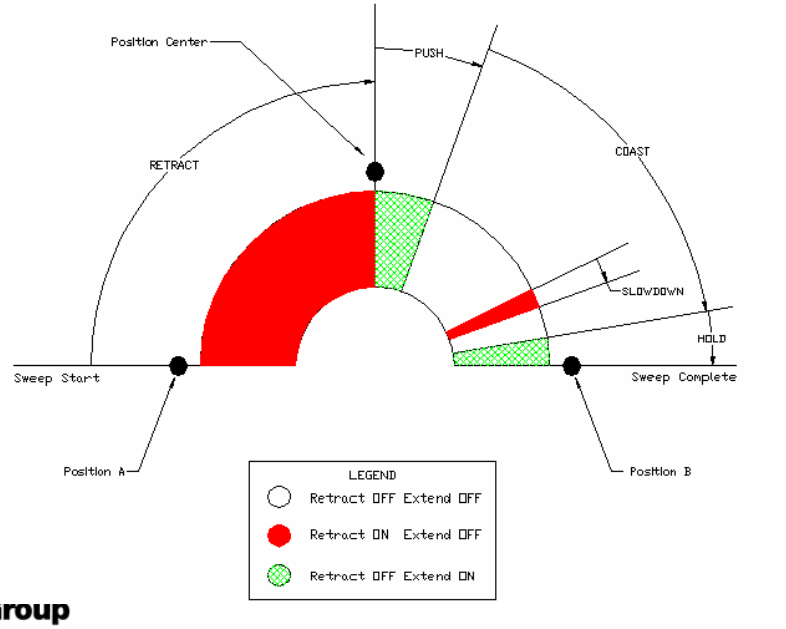
Control Programming

The turntable is intended to be controlled by a Genesis Systems Group Plug 'N Play controller, or by a machine's master controls. The Index Timing Chart represents proper operation of the turntable. Confirm operation by monitoring the pneumatic valve's LED output lights. It is important to the turntable's components that the table be in a coast state after mid sweep, prior to making contact with the shock absorber.

The Positioner's brake is used for Emergency Stop conditions only. It is not used to control speed of the Positioner, nor for positioning. Confirm this operation once, upon start-up and debug of the integration of this Positioner.

Index Timing Chart





Positioner Sweep Sequence

The Positioner sweep sequence can be simplified into five stages:

1) **Retract**
2) **Push**
3) **Coast**
4) **Slow down**
5) **Hold Position (Sweep Complete)**

1. Sweep Sequence – Retract

The Positioner sweep sequence begins with retracting the cylinder from a 'Hold' state. The 'Hold' needs to be released at the start of the 'Retract' sequence. When this sequence begins, the Sweep Cylinder Retract Coil is energized, thus beginning Positioner rotation. The sequence remains energized unless one of the following variables changes its logical state:

- Positioner Sweep Passes Center Position (normally lo a zero)
- OK to Sweep Input (normally logic one)
- Control Power On / Emergency Stop (normally logic one)

During normal operation, when position 'Center' is reached, the 'Push' stage of the Sweep Sequence begins.

2. Positioner Sweep Sequence – Push

When the Positioner sweep reaches position 'Center', a 'Push' is used to increase momentum of the Positioner. The Sweep Cylinder Extend Coil is energized during this time. When complete, the Sweep Cylinder Extend Coil de-energizes. This begins the initial 'Coast' stage of the Sweep Sequence. With heavy load capacity and large design configurations, it may not be necessary to have a 'Push'. In this case momentum from the initial 'Retract' sequence is sufficient to complete Positioner rotation.

The 'Push' remains energized unless one of the following variables changes its logical state:

- OK to Sweep Input (normally logic one)
- Control Power On / Emergency Stop (normally logic one)
- Push timer done

3. Positioner Sweep Sequence – Coast

During the 'Coast' sequence, the Positioner uses momentum from the 'retract' and 'push' stages to continue the sweep. Neither the 'Push' nor 'Retract' cylinder coils are energized during this stage of the sweep. When the 'Coast' timer is done, the 'Hold' stage of the Sweep Sequence begins.

4. Positioner Sweep Sequence – Slow Down

This sequence of the sweep is not used on every application. Smaller Positioner designs and lighter Positioner loads do not require this sequence. The logic may be included with the timer length set to 0.

To start the 'Slow Down', the Sweep Cylinder Retract Coil is energized for a very short duration of time, a 'pulse'. The 'Slow Down' is activated at a set time after the Positioner passes Positioner 'Center'. Normally this is activated halfway between position 'Center' and the 'Hold' sequence. This action removes Positioner momentum created from the Retract and Push stages of the sweep sequence. When slowdown is complete, the Sweep Cylinder Retract Coil de-energizes, and the Positioner coasts until the Hold sequence is activated.

5. Positioner Sweep Sequence – Hold Position

The 'Hold' sequence is activated at the end of the coast time. This should engage just prior to, or at the end of, rotation when the cylinder makes contact with the shock absorber or hard-stop. This sequence remains active until another sweep sequence starts (assuming Control Power remains on). The 'Hold' Position energizes the Sweep Cylinder Extend Coil to push and hold the Positioner against the hard-stop.

The 'Hold' remains active unless one of the following variables changes its logical state:

- At Position A or B (normally logic one)
- Control Power On / Emergency Stop (normally logic one)
- Sweep Request is made

Emergency Stop Conditions

When the machine is E-stopped, all electrical power is removed from the solenoids. This causes the table brake to engage, stopping the table.

Logic Timers

Logic Timers		
Timer	Genesis Systems Group Standard	User
PUSH	T4:0	
SLOWDOWN POINT	T4:1	
COAST	T4:2	
ABNORMAL SWEEP	T4:3	
WATCHDOG	T4:4	
SWEEP TIME	T4:5	
SLOWDOWN LENGTH	T4:6	

PUSH

Sets the length of time the extend cylinder coil is energized after the Positioner reaches position 'center'.

SLOWDOWN POINT

Sets the location of where the 'slowdown' sequence begins. This timer is enabled once the Positioner reaches position 'Center', and completes at the point where the Positioner is beginning its slowdown sequence.

COAST

This timer is enabled when the 'Push' timer is completed, and completes when the cylinder reaches the shock absorber.

ABNORMAL SWEEP

This timer is enabled when an abnormal sweep condition is created. It is used to apply the brake when an abnormal sweep condition occurs.

WATCHDOG

This timer is enabled at the start of rotation, when the initial request to sweep is present, or if the table is not at Station A or Station B. If the timer reaches its preset value, an abnormal sweep condition is created. This value is set according to the application's normal sweep time. The timer resets (stops timing) when the Positioner reaches Station A or B.

SWEEP TIME

Measures the length of time from sweep start to sweep complete.

SLOWDOWN LENGTH

Sets the length of time the retract cylinder coil is energized after the 'Slowdown Point' timer is complete.

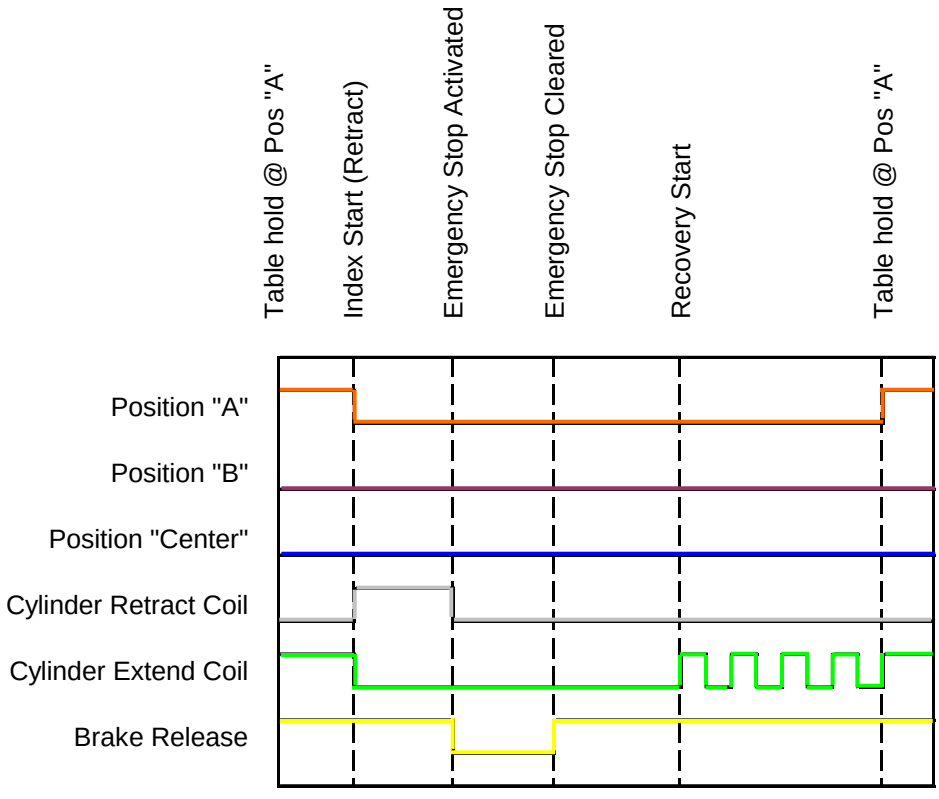
Index Recovery Control

Positioner rotation stops, and recovery of the Positioner's position is needed if any of the following events occur:

- If neither Position A nor Position B signals are true, and there is a logical event to stop rotation of the Positioner.
- If neither Position A nor Position B signals are true, and Control Power is false.
- Emergency stop.

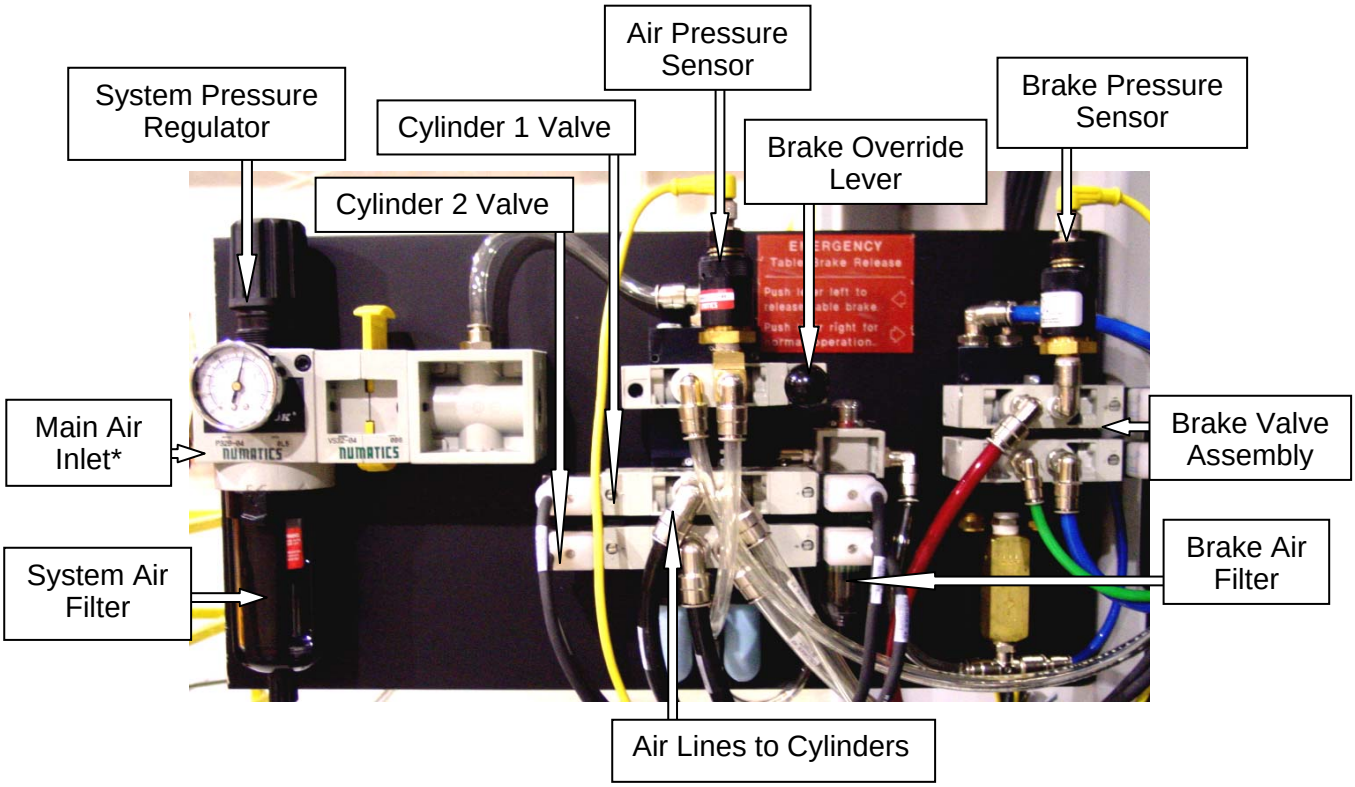
When any of these events occur, the Positioner brake output is de-energized, and any active step of the sweep sequence is deactivated.

To recover from this situation, the Positioner brake output needs to be energized. To recover the Positioner into position, the extend cylinder coil is pulsed until the Positioner reaches position ‘A’ or ‘B’. At that time the ‘Hold’ sequence is re-enabled.



Pneumatics Control

The pneumatic valve assembly is mounted on the side of the workcell. Refer to electrical schematics for wiring.



- Unrestricted 3/8” minimum inside diameter supply line
- Filtered, moisture-free compressed air at 80 psi minimum
- 75 cfm rating @ 2 indexes per/minute

Start-up

The Positioner's components must be checked, tested, and possibly adjusted before operations are started. Perform the following steps:

1) Check Shocks, Air, Wiring, Rotate Sweep

Before applying power to the system, complete the following tasks:

1. Make sure shock stiffness is at the setting indicated in the System Specifications table.

2. Make sure air pressure is at the setting indicated in the System Specifications table.

3. Make sure all air lines are tightened and are not in the motion area.

4. Make sure the sweep area is clear, then manually override the brake directional valve. With the brake released, rotate the sweep by hand to check clearances.

2) Test the Sweep

After checking the shocks, air, wiring, and sweep clearances, perform the following steps to test the sweep:

WARNING!

Before performing the following steps, make sure the sweep area and actuating area are clear of people and objects. Failure to keep these areas clear of people and objects could result in serious injury or even death!

1. Make sure the sweep and actuating areas are safe and secure. This should include, but not be limited to, robots clear of sweep, all gates closed, light curtains are functional, and headstock doors are closed or marked as dangerous.
2. Make sure the Emergency stop buttons are functional.
3. Initiate the sweep.

If an error occurs, refer to Start-up Troubleshooting.

The axis should sweep in one smooth, continuous motion. If necessary, make adjustments to the shocks and air pressure. For a system with balanced tooling within the recommended ranges, these external adjustments should be all that is necessary to make the sweep function properly.

For a system with maximum tool weight or unbalanced weights, it may be necessary to adjust parameter values, but first attempt to compensate by adjusting the shocks and air pressure. After making changes to parameters it may be necessary to adjust the shocks and air pressure again.

3) Adjust the Sweep

Adjust Shocks

If motion is abruptly reduced or reversed when the sweep contacts the shock, reduce the stiffness of the shock by increasing the setting value. Increase the setting in half number increments **only**. Finer adjustments may be necessary for final adjustment.

If the sweep bounces when it contacts the hard-stop, increase the stiffness of the shock by decreasing the setting value. Decrease the setting in half number increments **only**. Finer adjustments may be necessary for final adjustment.

IMPORTANT!: Do NOT adjust shock setting to less than 2. If setting is less than 2, shock life decreases dramatically.

NOTE: Adjustment settings apply to ACE shocks only. If using different shocks, check the manufacturer's instructions.

Adjust Air Pressure

Air pressure adjustment is not normally necessary but may be required in certain applications. If adjusting air pressure, refer to the System Specifications table for maximum and minimum allowable pressure settings, and note the following guidelines:

Increasing air pressure increases the sweep speed but it also increases the effect of the slowdown. Adjust air pressure in 5 psi increments.

Decreasing air pressure decreases the sweep speed but it also decreases the effect of the slowdown. Adjust air pressure in 5 psi decrements.

Air pressure adjustment also affects brake operation. If air pressure is too low (below 80 psi), the brake will drag on the brake disk, slow the speed of the table, and increase wear on the brake pads.

System Specifications

	3MH	3M3H	RCTL	RC3L
Capacities				
Exchange Speed	4 sec.	5 sec.	4 sec.	5 sec
Maximum Tool Diameter	n/a	40”	n/a	40-48”
Available Tool Lengths	96” table	60", 72"	96" table	60", 72", 84", 96"
Maximum Tool Weight (Per Side)	1500 lbs.	1500 lbs.	1500 lbs.	1500-2000 lbs.
Maximum Tool Imbalance (Rotational Minor Axis)	n/a	600in/lbs	n/a	600in/lbs
Maximum Imbalance Between Tool A and B	n/a	n/a	n/a	n/a
External Adjustment				
Maximum Air Pressure	90 psi.	90 psi.	90 psi.	90 psi.
Minimum Air Pressure	80 psi.	80 psi.	80 psi.	80 psi.
Recommended Air Pressure Setting	80 psi.	80 psi.	80 psi.	80 psi.
Initial Shock Absorber Setting	3.5	4	3.5	4.5
Flow Control Setting	n/a	n/a	n/a	n/a
Plug N Play Software Parameters				
ACOUNT_PRESET	3200	3200	3200	3200
BCOUNT_PRESET	100	100	100	100
DZ1L	800	800	800	800
DZ1H	1550	1550	1550	1550
DZ2L	1750	1750	1750	1750
DZ2H	2500	2500	2500	2500
AMAX_START	85	70	85	70
AMIN_START	65	50	65	50
AMAX_END	35	25	35	25
AMIN_END	20	15	20	15
BMAX_START	85	70	85	70
BMIN_START	65	50	65	50
BMAX_END	35	25	35	25
BMIN_END	20	15	20	15
SLOWDN_SIZE	1300	1500	1300	1500
RECOVER_MAX	25	25	25	25
RECOVER_MIN	15	15	15	15
Maximum MAX_START Value	100	85	100	85

Start-up Troubleshooting

Problem	Probable Cause	Action
Abnormal Sweep Stop (Plug 'N Play error)	Sweep was not in position when control power was turned on. Undefined condition stopped sweep.	Recover sweep to Side A or B.
Air Pressure Below Recommended PSI	Air supply shut off valve closed. User air supply insufficient. Improperly adjusted or faulty regulator. Improperly adjusted or faulty pressure switch.	Check status of shut-off valve. Check user air supply. Check functionality of regulator. Check functionality of pressure switch
Brake Release Fuse Blown (Plug 'N Play error)	Fuse is bad or wiring is faulty.	Check fuse and wiring. See electrical schematics for your system.
Brake Pressure Errors (Plug 'N Play error)	Brake pressure not present while output off.	Verify both brake solenoids are acting at same time. Check for main air pressure.
	Brake pressure present while output on.	
Control Power is Off	System E-stopped or faulty wiring.	Check status of E-string and wiring.
Extend Cylinder #1 Fuse Blown (Plug 'N Play error)	Fuse is bad or wiring is faulty.	Check fuse and wiring. See electrical schematics for your system.
Extend Cylinder #2 Fuse Blown (Plug 'N Play error)	Fuse is bad or wiring is faulty.	Check fuse and wiring. See electrical schematics for your system.
Possible A at Robot Proximity Sensor Failure	Faulty proximity sensor or wiring.	Check functionality of proximity sensor. Check wiring. See electrical schematics for your system.
Possible B at Robot Proximity Sensor Failure	Faulty proximity sensor or wiring.	Check functionality of proximity sensor. Check wiring. See electrical schematics for your system.
Possible Encoder Malfunction (Plug 'N Play error)	Encoder wheel not contacting actuator arm. Encoder channels A and B reversed. Faulty wiring. Pull-up resistors not functioning.	Make sure wheel is contacting actuator arm. Manually move encoder wheel back and forth while monitoring inputs 0 and 1 on PLC. If Inputs do not flicker when wheel is moved check wiring. See electrical schematics for your system.
Retract Cylinder #1 Fuse Blown (Plug 'N Play error)	Fuse is bad or wiring is faulty.	Check fuse and wiring. See electrical schematics for your system.
Retract Cylinder #2 Fuse Blown (Plug 'N Play error)	Fuse is bad or wiring is faulty.	Check fuse and wiring. See electrical schematics for your system.

Start-up Troubleshooting (continued)

Problem	Probable Cause	Action
Sweep stops just after leaving hard-stop.	Encoder signals reversed. Sweep Position value out of range (Plug 'N Play error). Safety circuit problem.	Check wiring of inputs 0 and 1. Recover sweep to either Side A or B and cycle control power. This will reinitialize the position count.
E-STOP occurs as soon as sweep begins.	Light curtain blocked or malfunctioning. Gate safety contact faulty. Faulty wiring in E-String. Safety circuit problem.	Test functionality of light curtain and gates or other safety device associated with sweep protection. Check user wiring.
Sweep hesitates mid sweep.	Directional valves controlling wrong cylinder. Brake drag.	Check valve wiring. See electrical schematics for your system. Check pneumatic plumbing. Check air pressure.
Sweep strikes hard-stop harshly and bounces in both directions of sweep.	Shocks stiffness too low. Tool imbalance too great for current parameter settings. Air pressure not sufficient for full slowing power.	Check shock settings. Replace shock if adjustments do not change characteristics of shock. Adjust parameter settings. Check regulator setting.
Sweep strikes hard-stop harshly and bounces in only one sweep direction.	Shock stiffness too low. Directional valve not able to apply retract pressure. Tool balance too great for current parameter settings.	Check shock settings. Replace shock if adjustments do not change characteristics of shock. Check functionality of directional valves to see if condition has been caused by a faulty coil on retract side of valve. This would also make the beginning of the sweep slower than normal but the sweep would still complete. Adjust parameter settings.
Sweep comes to complete stop before reaching hard-stop and then completes sweep.	Shock stiffness too high. Sweep MAX_END parameter too low. Air pressure too high.	Check shock. Replace shock if adjustments do not change characteristics of shock. Adjust parameter settings. Check regulator setting.
Sweep comes to complete stop or reverses direction before reaching hard-stop and then slams into hard top with bouncing.	Sweep MAX parameter slowdown slope too aggressive. Sweep MIN_END parameter may be too high.	Adjust parameter settings. .

Lockout/Tagout

Only trained personnel should perform maintenance. The following lockout/tagout procedures should be followed before performing any maintenance. In addition to these procedures, other practices may be needed. **It is the responsibility of the customer to consult safety professionals to determine and apply the best safety practices.**

> **WARNING!**
> Before performing any maintenance, use lockout/tagout procedures to prevent system operation. Failure to prevent operation could result in serious injury or even death!

Electrical

To prevent electrical power to the system from being turned on:

1. Turn the main enclosure's main disconnect to OFF.
2. Secure knife switch with a lockout/tagout device and padlock.

> **WARNING!**
> Lethal voltage is present in the enclosure whenever it is connected to a power source. Be extremely careful to avoid electrical shock.
>
> Turning the disconnect or knife switch to OFF removes power from the output side of the device only. High voltage is always present at the input side whenever the enclosure is connected to a power source.

Air

To prevent system air from being turned on:

1. Push the blocking valve down.
2. Secure valve with a lockout/tagout device and padlock.

System

To prevent system operation, press an E-stop button:

Shielding Gas

At the user supplied valve, turn off the shielding gas before performing any maintenance.

Tooling

Make sure all parts are removed.

Maintenance

Proper maintenance of the Positioner is essential for maintaining its optimum operating condition. Perform maintenance according to the schedules recommended in this manual. Also, refer to component manufacturers' documentation for additional maintenance instructions.

Before Every Shift

Positioner

Clean the positioner and remove any objects that are not needed for safe operation of the system. Remove excessive spatter and dust build-up on the work surfaces.

Air Pressure

Check air pressure. Make sure it is 80 – 100 psi.

Emergency stop Buttons

Check that every E-stop button stops table rotation.

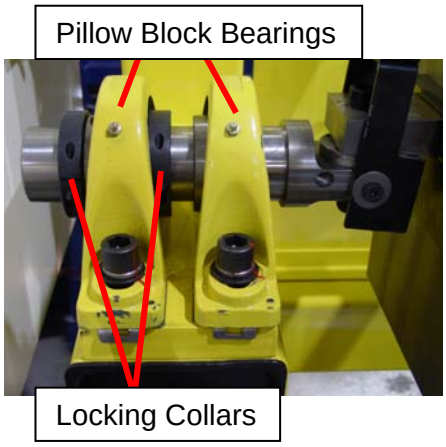
Weekly

Cable and Hoses

Check all external cables and flexible hoses for damage. Check hoses for abrasion, cracking, kinks and burns. Repair or replace as required, being careful to reroute hoses properly.

Axis Bearings & Locking Collars(3M3, RC3, RC3L)

Pillow block bearings are located at the tailstock ends of the axes. These bearings are greased before being shipped. They do not require any further lubrication or maintenance. Make sure the locking collars are tight.

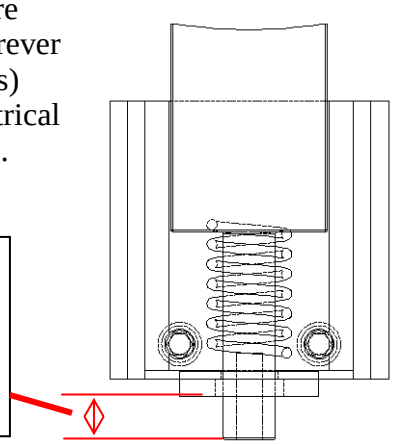


Gearboxes (3M3, RC3, RC3L)

A servo driven gearbox is located at the head of each minor axis. These gearboxes are greased before being shipped. They do not require further lubrication except for changing the grease every 20,000 hours of operation. They should be inspected for leaks. Check for fluid on the underside of the gearbox and faceplate, and on the floor. If a unit is leaking, call Genesis Systems Group.

Ground Brush (3M3, RC3, RC3L)

A ground brush may be located at the end of each minor axis. Once a week, lubricate each brush. To lubricate, pull back on the copper unit. Cover the entire surface of the copper unit (wherever it comes in contact with the axis) with a thin coat of 'Tweco Electrical Joint Compound and Lubricant'.



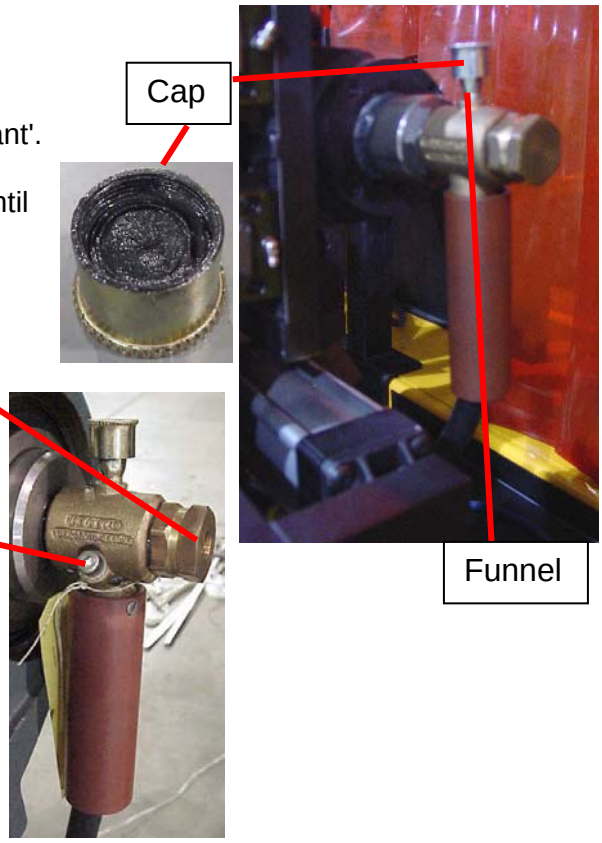
Roto-Ground Clamps (3M3, RC3, RC3L)

Roto-Ground clamps may be located at the end of each minor axis. The units are lubricated before being shipped. Once a week, turn the cap one full turn (360º). Turning the cap forces lubricant into the unit. When the cap is fully screwed down (can no longer be turned), then add lubricant. To add lubricant, perform the following steps:

1. Remove the cap.
2. Fill the funnel and cap with 'Tweco Electrical Joint Compound and Lubricant'.
3. Screw the cap back on, turning only until resistance is felt.

Make sure roto-ground is tight on the tailstock shaft (torqued to 90 ft.-lbs.).

Make sure unit makes firm contact with shaft yet is able to rotate. Hand-tighten bolt with wrench (snug), then back off 1/4 turn.

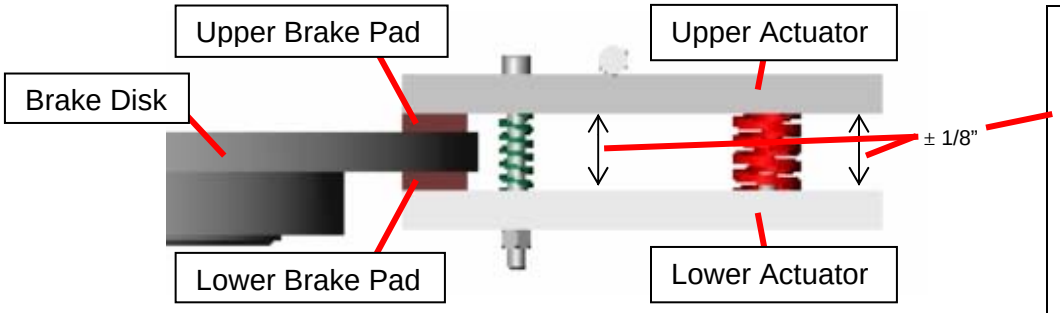


Semiannually

Brake

IMPORTANT!: Make sure the air supply to the brake is OFF.

> **WARNING!**
> Perform brake maintenance every **six months**. Failure to perform maintenance could lead to brake malfunction, and possibly cause serious injury or death!



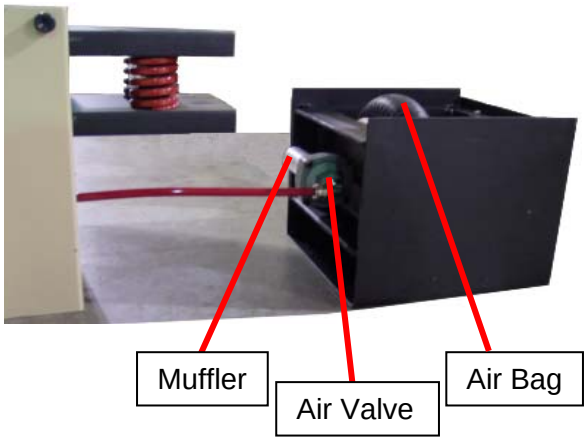
IMPORTANT! The actuators must be parallel to each other. Measure from the lower side of the upper actuator, to the upper side of the lower actuator (in two places), making sure measurements are within ± 1/8 inch of each other.

Brake Cover (Housing)

Carefully remove the brake cover (housing). It is attached to the air bag and to hoses. Remove the cover by raising it about an inch, so that its two nodes clear the holes they rest in, then sliding it away from the system.

Actuators

With the air supply to the brake OFF, make sure the upper and lower actuators are parallel to each other. If they are not parallel, adjust them using the brake's two pivot bolts.



Brake Pads

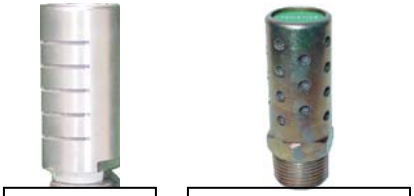
Check brake pads for wear. If pads are less than 1/8th inch thick, replace them.

Air Bag

Check the air bag and air valve for leaks by looking (with safety glasses on) and listening. Control power must be on.

Muffler

Use **only** a **clean** UCI MHC-3 or NUMATICS M3MN muffler on the brake's air bag.

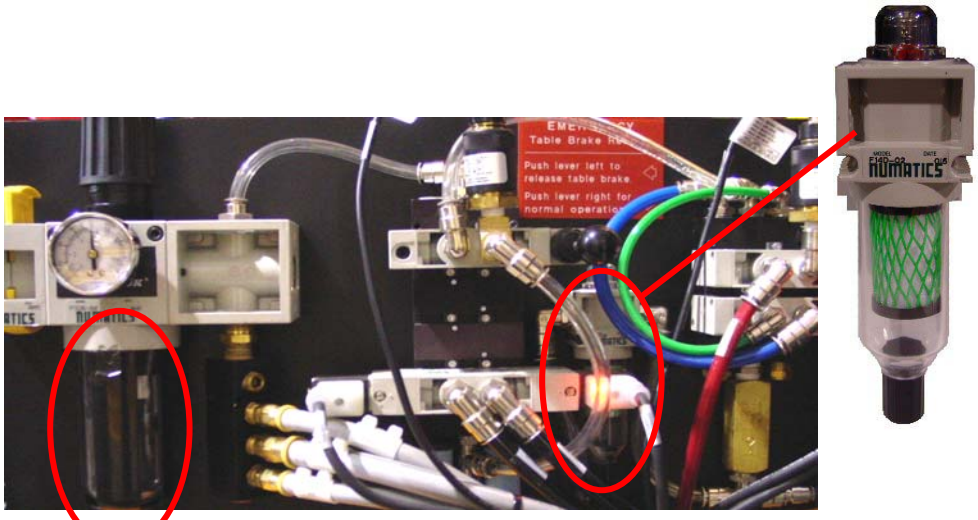


Air Filters

Brake

Every six months, inspect the brake air filter. If the filter is discolored (not white), replace it with the same type and brand.

> **WARNING!**
> Inspect the brake air filter every **six months**. Failure to perform maintenance could lead to brake malfunction, and possibly cause serious injury or death!



System

Every six months, inspect the system air filter. Look through the sight glass. If the unit is dirty, disassemble and clean it, or replace it.

Turntable Bearing

Grease the turntable (Rotek) bearing after the first ten days of operation. Then grease it every six months.

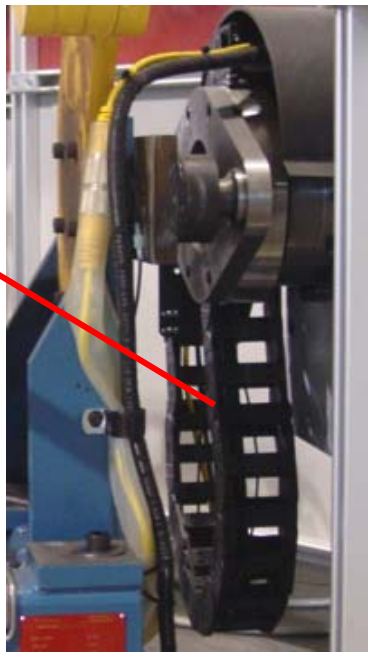
To grease the bearing, perform the following steps:

1. Pump grease into the fittings several times while rotating the bearing. Use a high-quality lithium based NLGI #2 or #3 bearing grease.

2. Check the seals. Repeat greasing and rotating until grease starts to seep out at the seals.

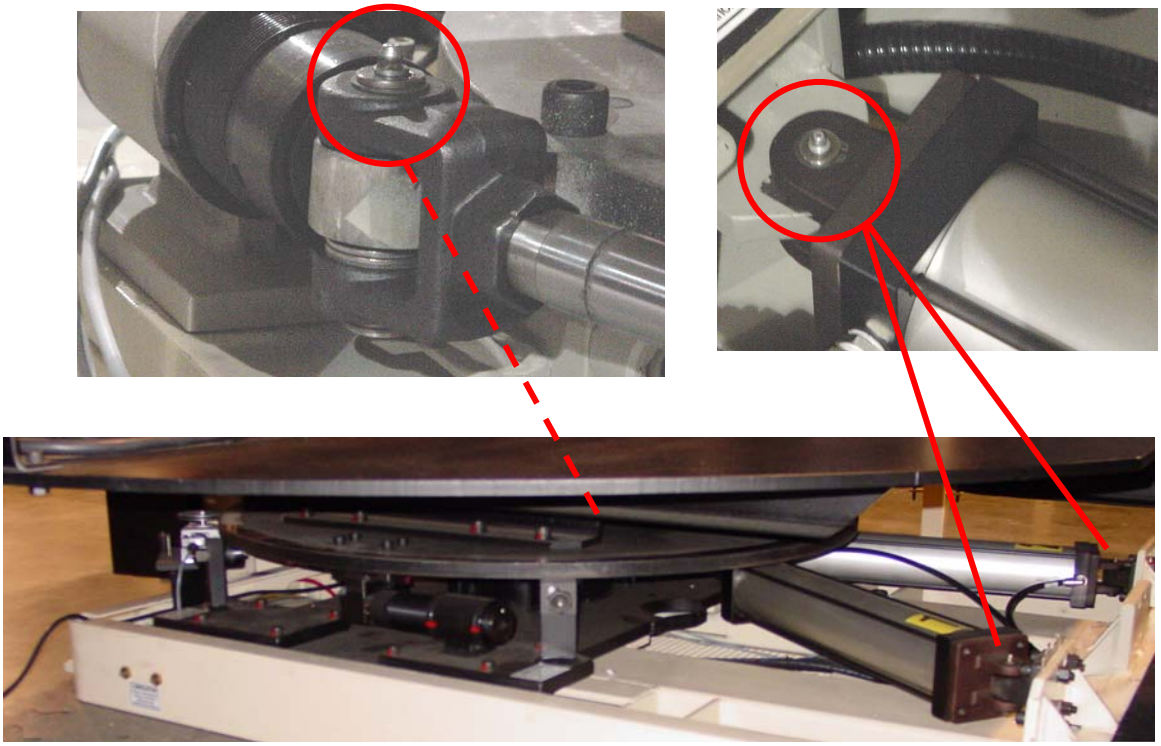
Cable Carriers (3M3, RC3, RC3L)

A cable carrier may be mounted at the headstock end of each minor axis. It protects the power cabling. Visually inspect it. Look for cracked or separated links. Replace if necessary. Make sure all fasteners are tight.



Cylinders

A grease fitting is located at each end of each cylinder. Give each grease fitting one pump of a high-quality lithium based NLGI #2 or #3 bearing grease.



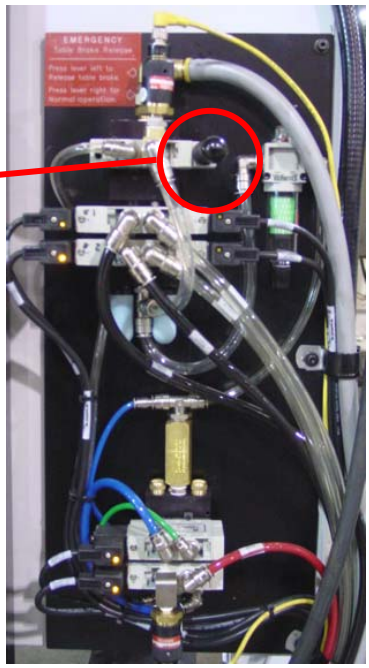
Cam Followers

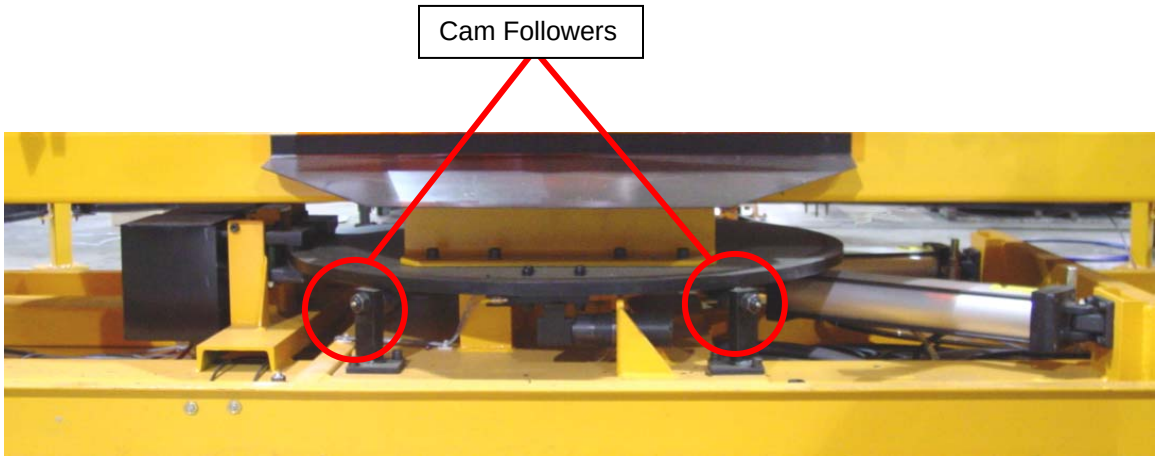
Each turntable has two cam followers on each side of the table, four total.

Look at each cam follower and see if they all touch the table.

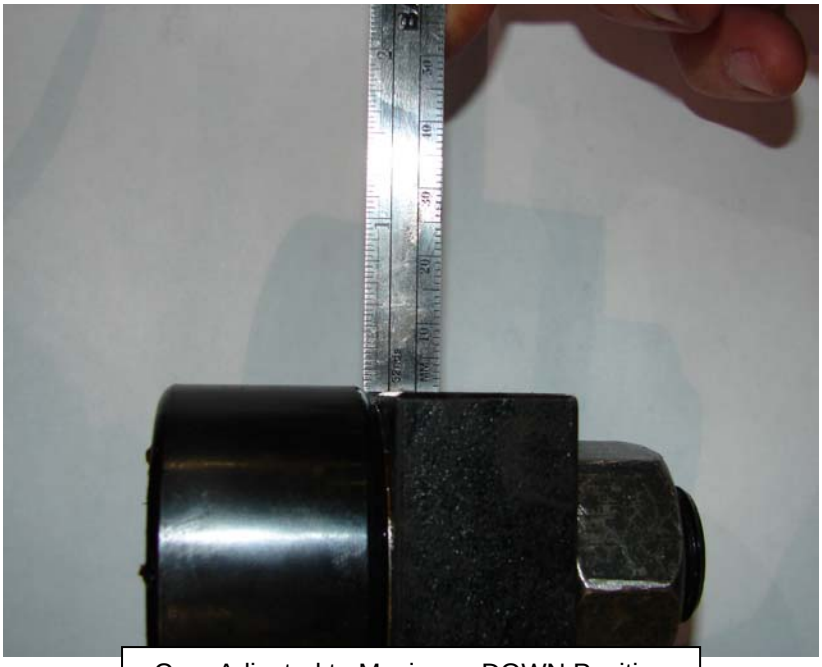
If a cam follower does not touch the table, perform the following steps:

1. Use an adjustable wrench to loosen the cam follower's jam nut. Use a 7/16 inch allen wrench to adjust the cam follower, up or down, so that it touches the table. **Retighten jam nut.**
2. Turn off the brake.
3. Rotate the table by hand, 180º, making sure the table rotates freely (does not bind). If table rotation binds or is impeded by any cam follower, lower that cam follower (only). **One or more cam followers may not touch the table at some points during rotation.**
4. If necessary, repeat step 3 for all cam followers.
5. Turn on brake.





Cam Adjusted to Maximum UP Position



Cam Adjusted to Maximum DOWN Position

Annually

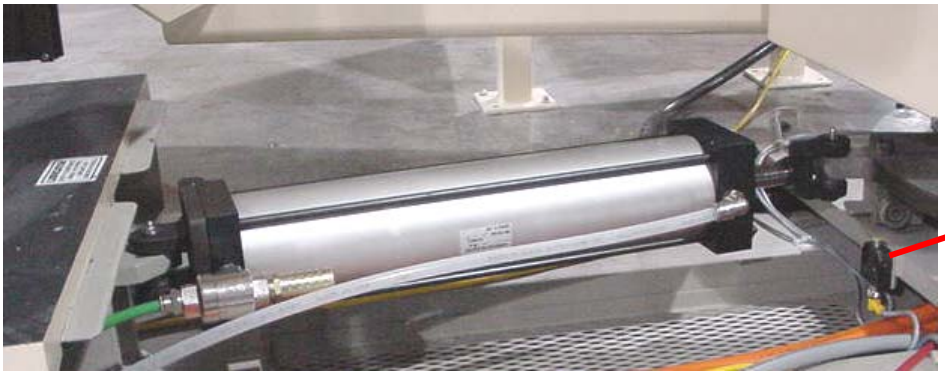
Proximity Sensors

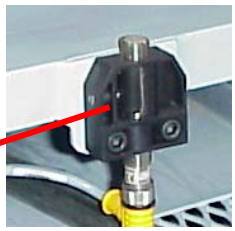
Proximity sensors (proxes) help ensure accurate positioning of the turntable. Proximity sensors are located under the turntable, on each side of it, and at the center point of its rotation.

Check each proximity sensor for tightness and proper distance from its target. The distance should be such that the LED lights up but the prox does not touch its target.

Jam nuts and prox brackets should be firmly tightened. Prox brackets should be fastened with lock nuts/washers and a removable thread locker if necessary.

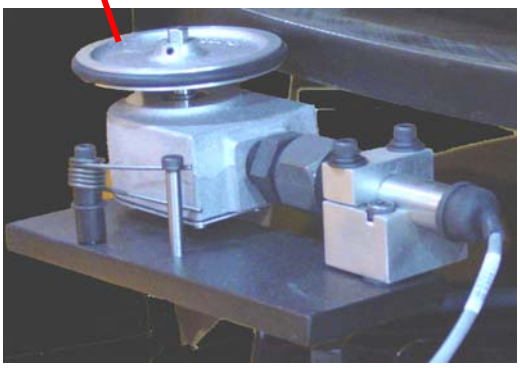
Examine prox cables for abrasion, cracks and burns. Replace as needed, using care when rerouting cables. Hand tighten cable plugs to proxes, being careful to not overtighten.





Encoder

If the Positioner has an encoder, the encoder helps ensure accurate positioning of the turntable. Look at the encoder. Make sure it is making contact with the table. Check the mounting bolt for tightness. Check the connections to the PLC for tightness.

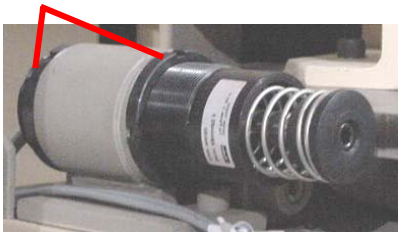


Programmable Logic Controller (PLC)

If the Positioner has a MicroLogix 1000 PLC, the PLC controls the rotation of the turntable. No maintenance is required. The unit does not have a battery. If problems occur with table rotation (encoder fault), then connections may be loose.

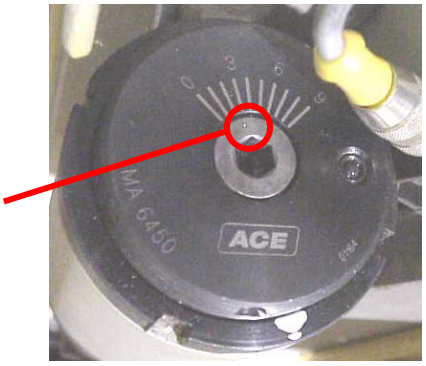
Shock Absorbers

A shock absorber is located on both sides of the turntable. Each shock absorber has two spanner nuts. Check that all spanner nuts are fastened securely. To tighten, use a spanner wrench and apply 75 to 100 lbs of force with about one foot-lever. Check each shock absorber for leaks. Replace if leaking.



NOTE: If the turntable bounces off the hard rest stop at the end of its rotation (noisier than normal), the shock absorbers are too loose. Adjust setting to a lower number.

If the turntable bounces off the shock at the end of its rotation, the shock absorbers are too stiff. Adjust setting to a higher number.



To adjust shock absorbers, use an Allen wrench to turn the dial, adjusting (at the most) to the next half number increment. For example, adjust from 3 to 3½ or from 3 to 2½. DO NOT adjust shock absorbers to less than 1½.

IMPORTANT!: The shock is not used as a hard stop. If a shock absorber is replaced, make sure there is a 3/16" stroke left in the shock when the hard stops are against each other.

NOTE: Adjustment settings apply to ACE shocks only. If using different shocks, check the manufacturer's instructions.

Ground Lug Nuts

Check that each ground lug nut connection is tight.

Tighten size 1/2"-13 to 80 ft.-lbs.
Tighten size 3/8"-16 to 32 ft.-lbs.

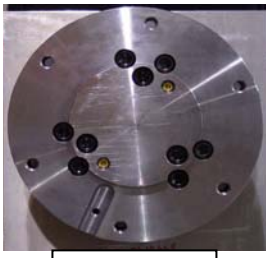
Check that the cable is firmly terminated. Examine the 4/0 ground cable insulation for abrasion and cracking. Repair or replace as required. If unable to replace, use electrical tape to cover bare cables until they can be replaced.

Every 20,000 Hours of Operation

Gearboxes (3M3, RC3, RC3L)

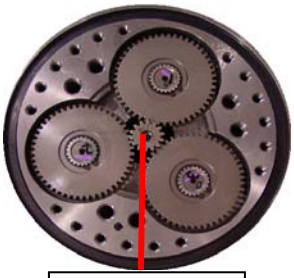
A servo driven gearbox is located at the head of each minor axis. Every 20,000 hours of run time, change the grease in each gearbox. To change the grease:

1. Remove the tool.
2. Rotate the axis for about 15 minutes to warm up the grease and make it flow more easily.
3. Each gearbox has two plugs. Locations vary depending on the gearbox. It may be that both plugs are on the front side, or one plug is on the front and one on the back. Locate the plugs. Make sure the axis is positioned so that the two plugs are aligned vertically. Remove the plugs.
4. Siphon the grease from the lower hole into an acceptable container. Use CAUTION – grease may be HOT!
5. Pump grease into the lower hole so that the grease works its way up into the gears. Refer to the Gearbox Lubrication Quantities chart to determine the type and quantity of lubrication.
6. Replace plugs.



Horizontal

Vertical



Center shaft

NOTE: Horizontal/vertical refers to the orientation of the center shaft.

Gearbox Lubrication Quantities

MAKE	MODEL	LUBRICANT	APPLICATION	QUANTITY (pints)
SUMITOMO	F2C-T35	OPTIMUM LONGTIME PD0	HORIZONTAL	.40
SUMITOMO	F2C-T35	OPTIMUM LONGTIME PD0	VERTICAL	.51
SUMITOMO	F2C-T45	OPTIMUM LONGTIME PD0	HORIZONTAL	.53
SUMITOMO	F2C-T45	OPTIMUM LONGTIME PD0	VERTICAL	.66
SUMITOMO	F2C-T65	OPTIMUM LONGTIME PD0	HORIZONTAL	1.24
SUMITOMO	F2C-T65	OPTIMUM LONGTIME PD0	VERTICAL	1.54
Nabtesco	RV-40E	MOLYWHITE RE00	HORIZONTAL	.41
Nabtesco	RV-40E	MOLYWHITE RE00	VERTICAL	.5
Nabtesco	RV-80E	MOLYWHITE RE00	HORIZONTAL	.81
Nabtesco	RV-80E	MOLYWHITE RE00	VERTICAL	.97
Nabtesco	RV-110E	MOLYWHITE RE00	HORIZONTAL	.91
Nabtesco	RV-110E	MOLYWHITE RE00	VERTICAL	1.1
Nabtesco	RV-320C	Greased and sealed by manufacturer – no change of grease req'd		
Nabtesco	RV-320E	MOLYWHITE RE00	HORIZONTAL	2.2
Nabtesco	RV-320E	MOLYWHITE RE00	VERTICAL	2.6
Nabtesco	RV-320EL	MOLYWHITE RE00	HORIZONTAL	6.97
Nabtesco	RV-320EL	MOLYWHITE RE00	VERTICAL	5.71
Nabtesco	RV-450E	MOLYWHITE RE00	HORIZONTAL	3.37
Nabtesco	RV-450E	MOLYWHITE RE00	VERTICAL	4.06
Nabtesco	RV-700EL	MOLYWHITE RE00	HORIZONTAL	10.88
Nabtesco	RV-700EL	MOLYWHITE RE00	VERTICAL	13.1
Nabtesco	RV-900C	MOLYWHITE RE00	HORIZONTAL	14.8
Nabtesco	RV-900C	MOLYWHITE RE00	VERTICAL	15.4
Nabtesco	GH7	MOLYWHITE RE00	HORIZONTAL	.275
Nabtesco	GH7	MOLYWHITE RE00	VERTICAL	.254
Nabtesco	GH17	MOLYWHITE RE00	HORIZONTAL	.623
Nabtesco	GH17	MOLYWHITE RE00	VERTICAL	.602
Nabtesco	GH24	MOLYWHITE RE00	HORIZONTAL	.634
Nabtesco	GH24	MOLYWHITE RE00	VERTICAL	.634
Nabtesco	GH40	MOLYWHITE RE00	HORIZONTAL	1.638
Nabtesco	GH40	MOLYWHITE RE00	VERTICAL	1.257
Nabtesco	GH100	MOLYWHITE RE00	HORIZONTAL	3.886
Nabtesco	GH100	MOLYWHITE RE00	VERTICAL	N/A

Maintenance Chart

Use this chart as a reference for doing maintenance and to record the dates when maintenance is done. Also, refer to the component manufacturers' documentation for additional maintenance instructions.

✓ - check L - lubricate + - clean	Before Every Shift	Weekly	Every Six Months	Annually	Every 20,000 Hours
Positioner	+				
Air pressure	✓				
E-stop buttons	✓				
Cables & hoses		✓			
Locking collars		✓			
Ground brush Roto-ground		L L			
Brake			✓		
Air filters			✓		
Turntable bearing			L		
Cable carriers			✓		
Cylinders			L		
Cam followers			✓		
Proximity sensors				✓	
Encoder				✓	
Shock absorbers				✓	
Ground lug nuts				✓	
Gearboxes		✓			L-change

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